

Instruction Manual

Relay-Equipped Electric Ball Valve (2-Port Valve)

MXB1D-10 to 50

MXB1DF-15 to 40

- Be sure to read this instruction manual before using the product.
- In particular, read the safety instructions carefully.
- Keep this instruction manual in a safe place so that you can readily take it out and read it whenever necessary.

Introduction

Thank you for choosing CKD's relay-equipped electric ball valve (motor valve) "MXB1D/MXB1DF type."

1. Purpose of Use
Motor-driven ball valve for use in general industrial machinery and equipment.
2. Applications
The product is ideal as a valve for automatic control and centralized control systems in piping lines for tap water, industrial water, hot water, hydraulic oil, compressed air, etc.
3. General Precautions
 - This instruction manual describes the basics regarding product handling, including unpacking, installation, use, and maintenance.
 - The installation contents of this instruction manual are written for mechanical and electrical engineers.
Read this manual carefully before design and installation, and take care to ensure the safety of machinery and equipment and to handle this product appropriately.
4. Safety Precautions
 - Warning messages are included in appropriate places to avoid personal injury and extensive damage to property such as fire.
Be sure to follow them without fail.
 - Warning labels should be classified as "Danger," "Warning," or "Caution" based on risk assessment. However, since this product is a component used in machinery and equipment, all are described as "Caution."

Display example



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1. Unpacking

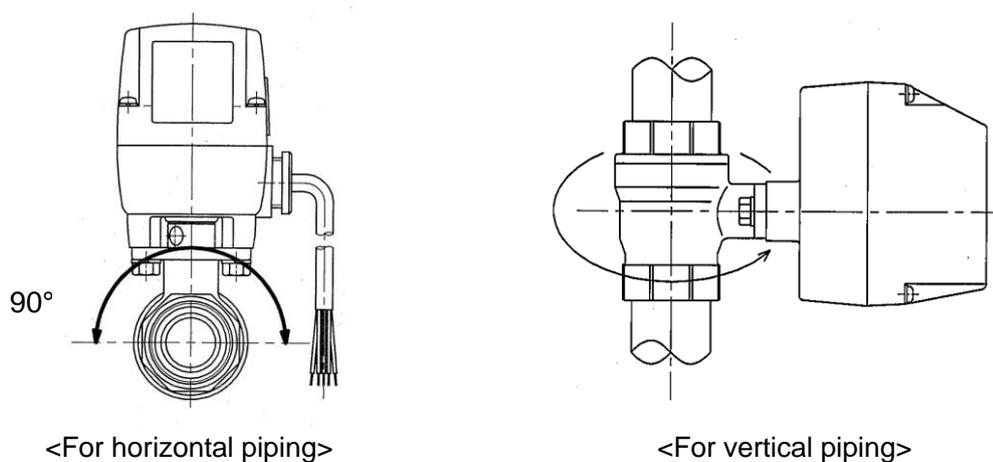
- Check that the model number of the product you ordered is the same as the one on the product nameplate.
 - Make sure that the rated voltage and rated frequency match.
 - Check that there is no external damage.
 - During storage, keep the seal plug attached to the valve to prevent foreign matter from getting inside.
- When piping, remove the seal plug.

2. Construction

2.1 Installation Conditions

2.1.1 Installation Position

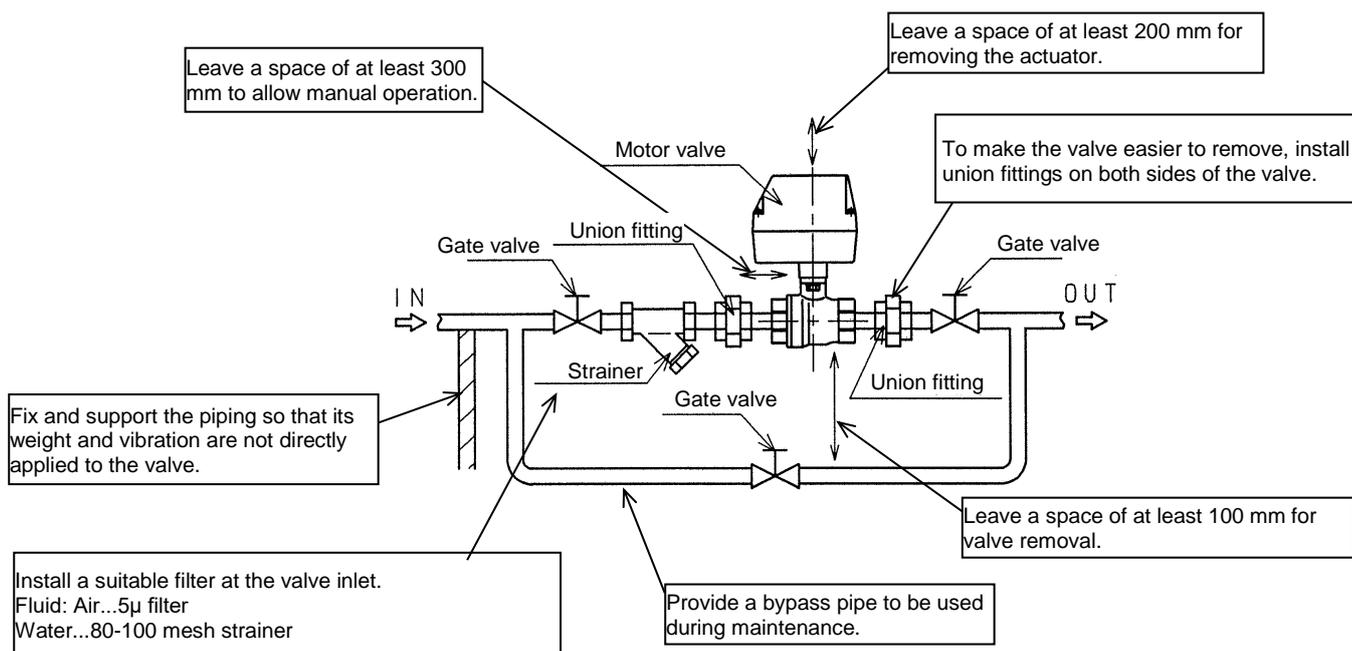
- The installation position should be within the range of $\pm 90^\circ$ with the actuator facing upward. (Figure 1)



(Figure 1 Installation position)

2.1.2 Maintenance Space

Secure sufficient space for safe maintenance and troubleshooting. (Figure 2)



(Figure 2 Piping model)

2.1.3 Product Protection

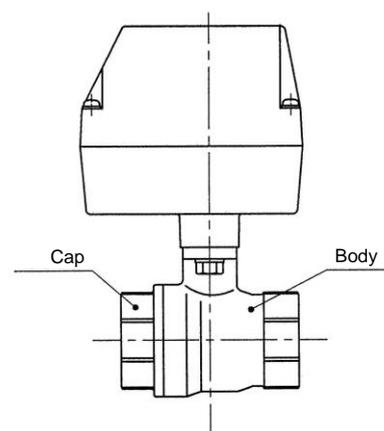
- If using the product in a cold region, take appropriate anti-freeze measures.
- When using this product in machinery or equipment to be cleaned with a water jet (hose), protect it with a cover or other means to prevent water from getting on it. This product is dustproof and waterproof according to the IEC-529 standard IPX3.
- Avoid using it outdoors.

2.2 Piping

- When handling or installing the product, be sure to hold the body.
- When connecting piping to this product, the valve has no specified flow direction.
- For the piping on the cap side, secure the cap with a wrench or similar tool and screw it in.
- For the piping on the body side, secure the body with a wrench or similar tool and screw it in.
- Fix and support the piping so that its weight and vibration are not directly transmitted to the valve.
- When using insulation, do not cover the actuator.
- Refer to Table 1 for tightening torque during piping.

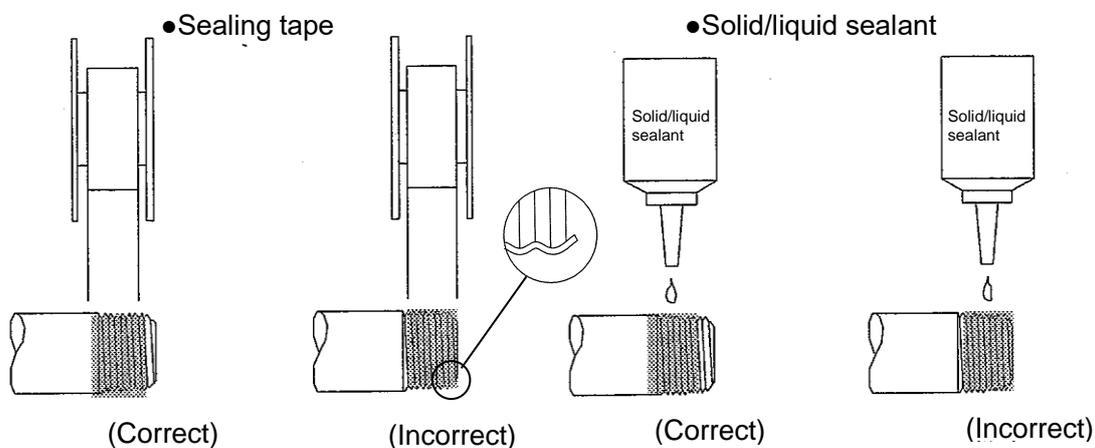
Table 1 Recommended piping tightening torque

Nominal diameter of pipe	Recommended tightening torque for piping
Rc3/8	31–33 [N·m]
Rc1/2	41–43 [N·m]
Rc3/4	62–65 [N·m]
Rc1	83–86 [N·m]
Rc1 ¹ / ₄	97–100 [N·m]
Rc1 ¹ / ₂	104–108 [N·m]
Rc2	132–136 [N·m]



(Figure 3 External view)

- Before installing the piping, check that there is no foreign matter, chips, or burrs on the piping material. To clean the pipe, spray air at a pressure of 0.3 MPa or more to remove foreign matter, chips, and burrs from inside the pipe.
- When using sealant, be careful not to let it get inside the piping and ensure no leakage outside. When wrapping sealing tape around a threaded part, leave 2 to 3 threads at the tip of the screw. (Figure 4) When using liquid sealant, apply it sparingly, leaving 2 to 3 threads at the tip of the screw. Do not apply it to the female thread side of the equipment.



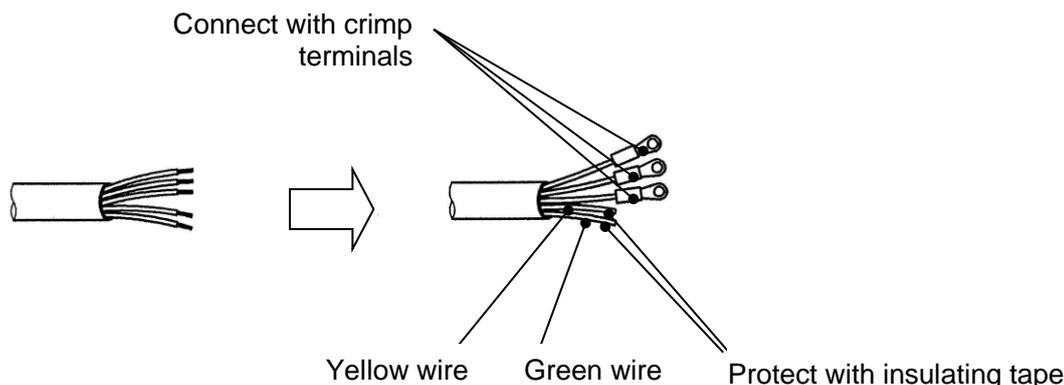
(Figure 4)

2.3 Wiring

**Caution**

When connecting to the power supply, connect correctly according to the motor valve wiring diagram (displayed on the product). If you make a mistake, it may cause a short circuit.

- When you do not use the yellow and green wires for signal check, cut off the exposed core wires and be sure to insulate them with insulating tape. (Figure 5)



(Figure 5 Handling of core wire)

- Secure the lead wire with a wire band or similar to prevent it from being pulled. When using in a location where there is a risk of damage to electrical wiring, take safety measures such as installing electrical conduit wiring.
- Avoid using switches that may allow signals to be input at the same time.
- When using a signal taking-out line for high-capacity loads, micro loads, etc., use it within the micro switch's specified operating range. (Omron SS-5)
- When using the product in a location where it may be exposed to water, be sure to take appropriate protective measures for the lead wire connections.
- When wiring a terminal box with a lamp, do not remove the cover by pulling it with excessive force. The crimp terminals inside will bend, causing the lamp to malfunction and poor insulation.
- For circuit diagrams and operation explanations, see pages 12-14. The power-on time required to open and close the valve is shown in Table 2-1. If the product is not used for more than one day, the initial activation time may become longer by about 1 to 5 seconds.

Table 2-1 Activation time

Model	AC voltage specification (50Hz/60Hz)
MXB1D-10 to 25	10/8 seconds
MXB1DF-15 to 20	
MXB1D-32 to 50	13/11 seconds
MXB1DF-25 to 40	

When switching the valve open/close signal, make sure that the next signal is input only after the valve has finished operating.

If the valve is stopped midway or switched during operation, it may cause malfunction and reduce durability.

3. Check before Use (Post-Installation Check)

3.1 Appearance Check

Caution Stop the fluid flow. (Close the main valve)
Turn off the power.

- Push the ball valve body by hand to make sure it is securely fixed to the pipe.
- Check that threaded parts such as hexagon bolts are not loose.

3.2 Electricity Check

Caution Turn off the power.

- Make sure the wiring is correct according to the motor valve wiring diagram indicated on the product.
- Insulation resistance check
Measure the insulation resistance between the ball valve body and the live part. (Table 3-1)

Table 3-1 Insulation resistance

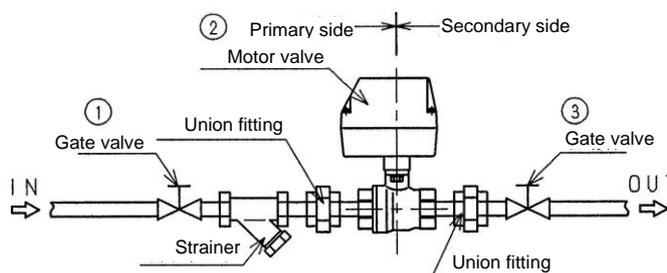
Power source type	Applied voltage	Insulation resistance
AC voltage specification	DC 1000 V megger	100 MΩ or more

3.3 Leak Check

- Turn on the power.
- Apply fluid pressure and check for leaks from the connections.
To check for leaks, it is recommended to supply compressed air (0.3 to 0.5 MPa), apply soapy water, and check for bubble generation.

<Procedure>

- After closing the motor valve ②, open the gate valves ① and ③ in that order, and ensure that there is no leakage to the outside or secondary side.
- After keeping the gate valve ① open and closing the gate valve ③, operate the motor valve ② to open, and ensure that there is no leakage to the outside.



(Figure 6 Piping diagram)

4. Proper Use



Caution

Be sure to observe the operating frequency (energization frequency). (Table 4-1)
The thermal protector may be activated and cause the unit to shut down. When locked, the unit will remain continuously energized, which puts a strain on the gear and coil. So, immediately stop energization and resolve the problem. Continued use may result in malfunction or reduced durability.

Table 4-1 Operation frequency

Model	AC voltage specification
MXB1D-10 to 25	2 times/min or less
MXB1DF-15 to 20	
MXB1D-32 to 50	1 time/min or less
MXB1DF-25 to 40	

- The energization time required for opening and closing is shown in Table 2-1. See page 5. If the product is not used for more than one day, the initial activation may take about 1 to 5 seconds longer.
- If the valve has not finished operating after the operating time specified in Table 2-1 has elapsed,
 - 1) the valve may have become stuck and locked
 - or 2) there may be a malfunction in an electrical component.
 ->Refer to “7. Troubleshooting.”
- Do not apply an external force of 0.5 N·m or more to the actuator.
- Keep the voltage fluctuations within $\pm 10\%$ of the rated voltage.
- When switching the valve signal, make sure that the next signal is input only after the valve has finished operating.
If the valve is stopped midway or switched during operation, it may cause malfunction and reduce durability.
- In the event of a power failure, the valve will remain in the state it was in before the power failure. -> Perform the gate valve operation in the piping model shown on page 3 (Figure 2), or perform the manual operation on page 9.

5. Disassembly and Assembly

5.1 Actuator Replacement

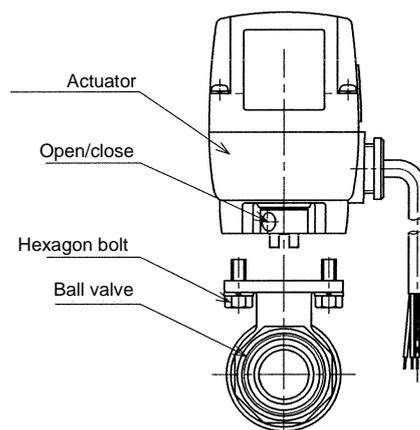
5.1.1 Disassembly Procedure



Caution

Turn off the power and stop the fluid before starting work.

- Remove the wiring.
- Loosen the hex bolts with a wrench.
- Lifting the actuator up separates it from the ball valve body.



(Figure 7)

5.1.2 Assembly Procedure

- Align the open/close position of the ball valve body with the open/close indicator hole on the new actuator.
- Tighten the hexagon bolts to a torque of 5 to 7.5 N·m.
- Attach crimp terminals to the lead wires.
- Carry out wiring according to the wiring diagram.
- Measure the insulation resistance between the ball valve and the live part.
For AC specifications: Measure with a DC 1000 V megger and ensure 100 MΩ or more.
- Turn on the power and activate the fluid circuit.

5.2 Ball Valve Replacement

5.2.1 Disassembly Procedure



Caution Turn off the power and stop the fluid before starting work.

- Loosen the hexagon bolts and separate the actuator.
In so doing, be careful not to apply a tensile force to the lead wires.
- Loosen the piping of the ball valve.

5.2.2 Assembly Procedure

- Install a new ball valve in the piping.
For the piping on the cap side, secure the cap with a wrench. For the piping on the body side, secure the body with a wrench. Then, carry out piping.
- Assemble the actuator to the ball valve.
Tighten the hexagon bolts to a torque of 5 to 7.5 N·m.
- Apply fluid pressure and check that the fluid is not leaking out.
- Turn on the power and activate the fluid circuit.

6. Maintenance



Caution

: **Never remove the bonnet.**

Touching the internal electrical components may result in electric shock.

: **Do not disassemble.**

If a problem occurs, do not disassemble the product; contact your nearest distributor or our sales office. If you disassemble the product, it will be impossible to investigate the cause.

6.1 Maintenance and Inspection

- To ensure optimal use of this product, inspect it regularly, usually once every six months.
- For inspection details, refer to "3. Check before Use (Post-Installation Check)."

6.2 Maintenance Parts

- Actuator
Replace it if an electrical failure or abnormality is detected. As a guideline, it can be operated 100,000 times.
- Ball valve body
Replace it if any abnormalities such as leakage or sticking of the valve are found during use.
As a guideline, it can be operated 50,000 times.

7. Troubleshooting

- In the event of a power failure or an emergency such as an abnormal operation, perform manual operation as follows.



Caution

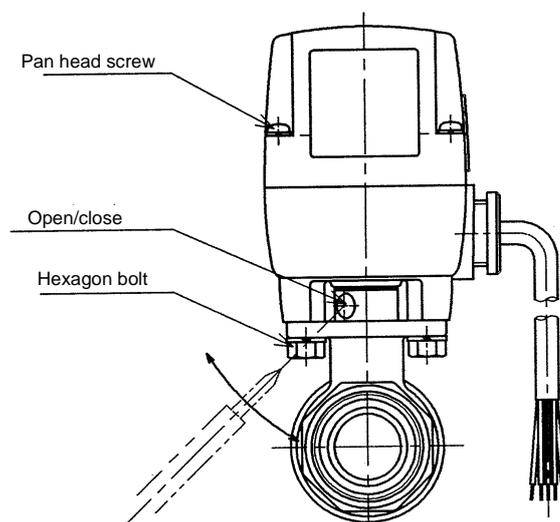
Products MXB1D-32 to 50 and MXB1DF-25 to 40 cannot be operated manually unless they are manual option products. There is a risk of damaging the motor gear inside the actuator. Use a product model with the manual operation option.

<Manual operation method>

- Turn off the power.
- For small diameters (standard bore: Rc3/8 to Rc1, full bore: Rc1/2 to Rc3/4), insert a rigid object such as a Phillips head screwdriver (H2 type, No. 2) into the open/close indicator hole in the intermediate bush of the motor valve and turn it slowly.
- For large bore sizes (standard bore: Rc1 1/4 to Rc2, full bore: Rc1 to Rc1 1/2), insert a rigid object such as a Phillips screwdriver under the connection key in the intermediate bush. With the clutch disengaged, turn it slowly.
- Operate the valve from closed to open and from open to closed in about 20 seconds.
- For both small and large bore sizes, turning the valve counterclockwise when viewed from above sets it to "open," while turning it clockwise sets it to "close."

<Precautions before a manual operation>

- Be sure to turn off the power before performing this operation.
- When turning, do not apply a sudden, large force. This will result in damage to the gears.
- After the manual operation of a large bore size (standard bore: Rc1 1/4 to Rc2, full bore: Rc1 to Rc1 1/2), return the clutch to its original position and make sure that it is securely re-engaged before use.
- Do not perform manual operation except in an emergency.



(Fig. 8 External view)

- If the motor valve does not operate as intended, inspect it according to the table below.

Table 7-1 Troubleshooting

Fault condition	Cause	Countermeasure
Does not operate	The power is not turned on	Check the wiring and fuse, and then turn on the power.
	Below rated voltage.	Check the power supply and input the rated voltage.
	Foreign matter caught inside the ball valve.	Inspect the inside of the ball valve and remove the cause. Or replace the ball valve.
	Ball seat stuck.	
	Actuator failure.	Replace the actuator.
The valve operates but does not function normally. (The actuator vibrates. It stops midway.)	Foreign matter caught inside the ball valve.	Inspect the inside of the ball valve and remove the cause. Or replace the ball valve.
	Ball seat stuck.	
The motor moves, but the valve does not move.	Gearhead is damaged or has reached the end of its life.	Inspect the inside of the ball valve and remove the cause. If there is no problem with the valve, replace the actuator. If both are abnormal, replace the product.
It's leaking.	Foreign matter caught inside the ball valve.	Replace the ball valve.
	Worn ball seat.	
		The power is on for a short time and the valve is not fully closed.

- If you have any other questions, please contact us or our distributor.

8. Internal structure diagram

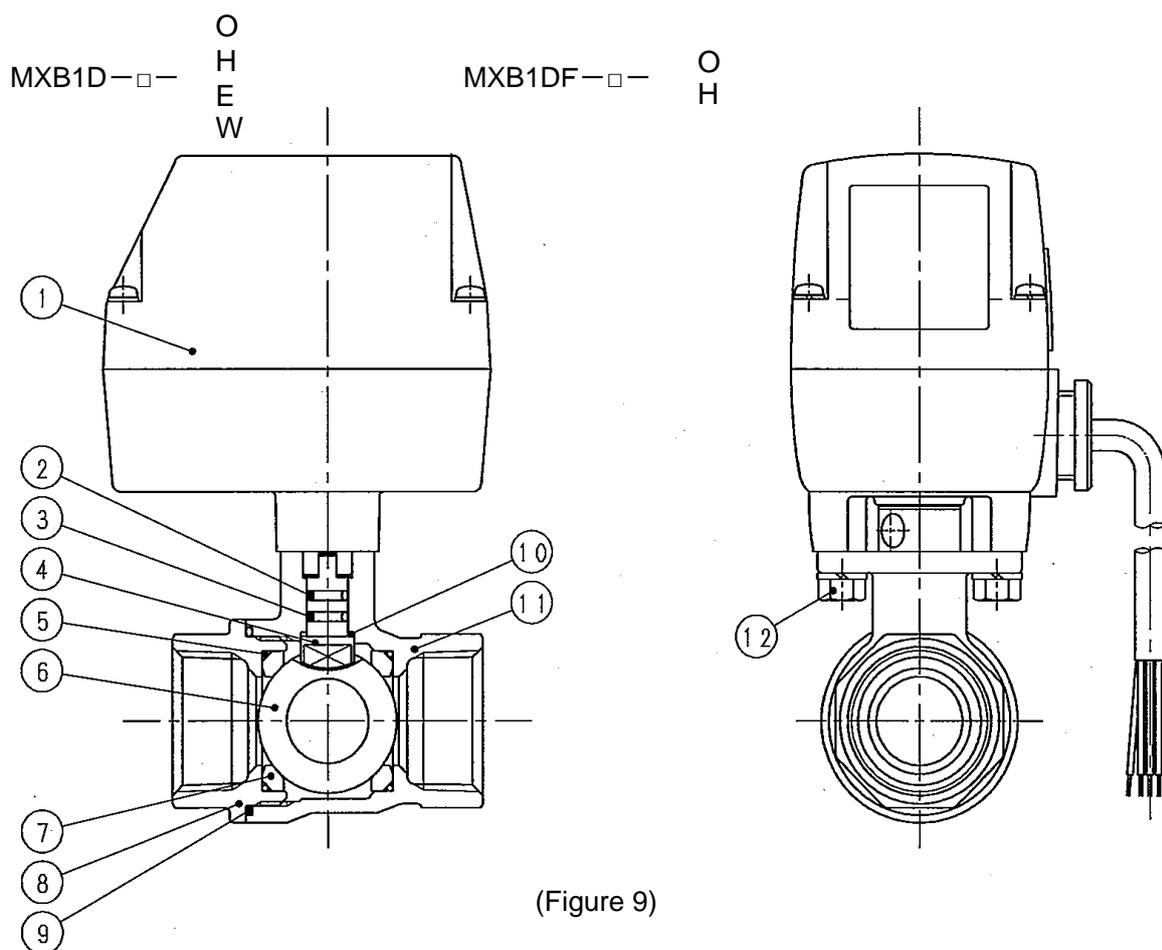


Table 8-1 Parts list

Part No.	Part name	Quantity	Material
①	Actuator	1	
②	O-ring	1	NBR (FKM)
③	O-ring	1	FKM
④	Shaft	1	SUS303 (SUS304)
⑤	O-ring	2	FKM
⑥	Valve ball	1	C3771 Cr plating (SUS304)
⑦	Ball seat	2	PTFE
⑧	Cap	1	Low-lead bronze (SCS13)
⑨	O-ring *2	1	FKM
⑩	Spacer *2	1	PTFE
⑪	Body	1	Low-lead bronze (SCS13)
⑫	Hexagon bolt	2	SWCH

*1: () indicates when the ball valve body material is stainless steel (E/W).

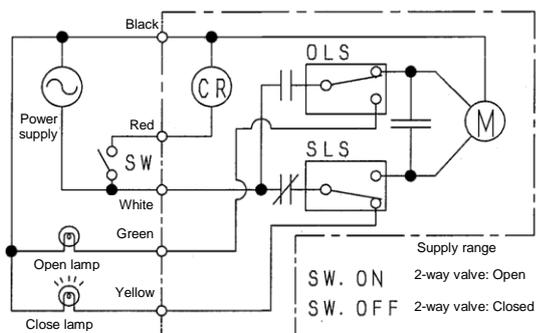
*2: When the ball valve body material is bronze (O/H), there is no O-ring (9) and spacer (10).

9. Circuit Diagram and Operation Description

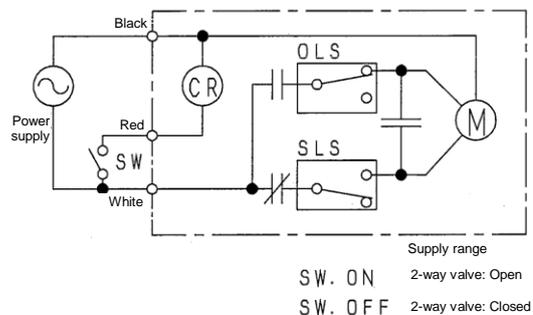
9.1 Circuit Diagram

9.1.1 AC Voltage Specification

- Standard type



- Option (3-core cable)

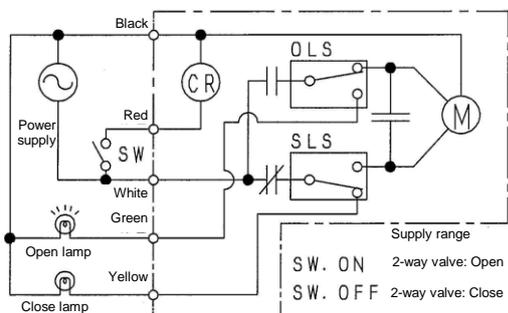


(Figure 10)

9.2 Operation Description

9.2.1 Standard (including option B)

(1) Opening operation (fully closed -> fully open)



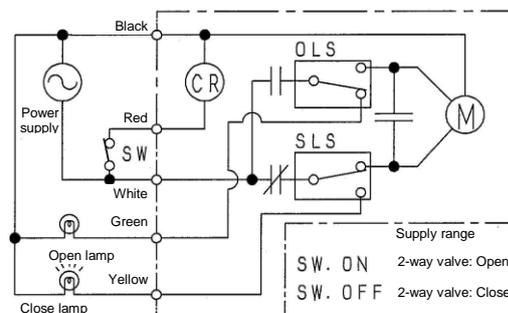
(Fig. 11: Closing operation complete)

When the operation switch is switched to the ON position from the status in Figure 11 and electricity is applied between the black–white and red lead wires, the motor will start to rotate and the output shaft will turn counterclockwise (seen from the top of the actuator toward the valve side).

When the valve is fully open, the OLS contacts switch, the motor stops, and the open lamp lights up. If you connect a relay instead of the open lamp, you can operate other equipment.

(Figure 12)

(2) Closing operation (fully open -> fully closed)



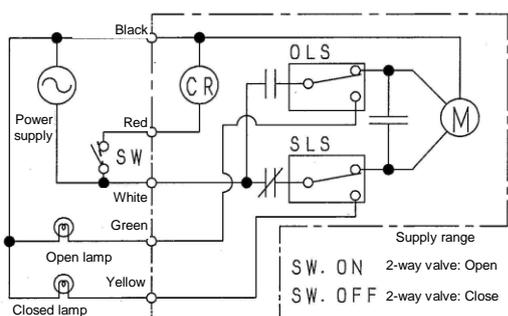
(Figure 12: After opening operation)

When the operation switch is turned OFF from the state shown in Figure 12 and electricity is applied between the black–white lead wires, the motor will start to rotate and the output shaft will turn clockwise (seen from the top of the actuator toward the valve side).

When the valve is fully closed, the SLS contacts switch, the motor stops, and the closed lamp lights up.

If you connect a relay instead of the closed lamp, you can operate other equipment. (Figure 11)

(3) During opening/closing operation



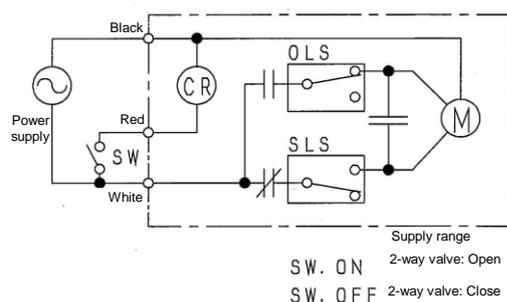
(Figure 13 During operation)

During operations (1) and (2), the OLS and SLS are in the state shown in the left figure. When the operation switch is turned ON or OFF, the output shaft rotates accordingly.

However, reversing the operation may damage the gears.

(Figure 13)

9.2.2 Option: T (3-core cable)



(Figure 14)

- (1) Opening operation (fully closed -> fully open)
When the operation switch is turned ON and electricity is applied between the black–white and red lead wires, the motor will rotate. At the fully open position, the cam will activate the OLS, switching the contacts and stopping the motor.
- (2) Closing operation (fully open -> fully closed)
When the operation switch is turned OFF and electricity is applied between the black–white lead wires, the motor will rotate. At the fully closed position, the cam will activate the SLS, switching the contacts and stopping the motor.

9.2.3 Option: L (with open lamp)

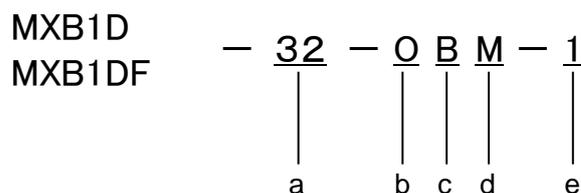
The open lamp in Figure 11 is housed in the terminal box. (1) When the opening operation (fully closed -> fully open) is completed, the lamp on the terminal box lights up. It does not light up during operation. (Wiring is the same as option T.)

9.2.4 Option: R (with closed lamp)

The closed lamp in Figure 12 is housed in the terminal box. (2) When the closing operation (fully open -> fully closed) is completed, the lamp on the terminal box lights up. It does not light up during operation. (Wiring is the same as option T.)

10. Product Specifications

10.1 Model Designation



a. Connection bore size

Symbol	Description	MXB1D (Standard bore)	MXB1DF (Full bore)
10	Rc3/8	•	—
15	Rc1/2	•	•
20	Rc3/4	•	•
25	Rc1	•	•
32	Rc1 1/4	•	•
40	Rc1 1/2	•	•
50	Rc2	•	—

b. Body and seal materials

Symbol	Description	
	Body	Seat
O	Bronze	PTFE
H		Reinforced PTFE
E	Stainless steel	PTFE
W		Reinforced PTFE

c. Options

Symbol	Description
No symbol	5-core cable (with signal output)
T	3-core cable
B	With terminal box (5 terminals)
L	With lamp-equipped terminal box (lights up when open)
R	With lamp-equipped terminal box (lights up when closed)

d. Manual operation

Symbol	Description
No symbol	Without manual operation (standard)
M	With manual operation Note 2.

e. Voltage

Symbol	Description
1	AC 100 V (50/60 Hz)
2	AC 200 V (50/60 Hz)

- Note 1. For connection port size 10, it is full bore, but the model number is MXB1D.
- Note 2. Manual operation is available only for MXB1D-32 to 50 and MXB1DF-25 to 40.
- Note 3. Stainless steel body cannot be manufactured for MXB1DF.
- Note 4. Option combinations except for TB are not available.

10.2 Product Specifications

Table 10-1 Product Specifications

Common Specifications

Model designation	MXB1DF-15		MXB1DF-20		MXB1DF-25	MXB1DF-32	MXB1DF-40
	MXB1D-10	MXB1D-15	MXB1D-20	MXB1D-25	MXB1D-32	MXB1D-40	MXB1D-50
Pressure resistance MPa	2 (water pressure)						
Working fluid	Water, hot water, air, oil (500 mm ² /s or less)						
Fluid pressure MPa	0–1					0–0.5	
Fluid temperature °C	0–80 (without freezing)						
Ambient temperature °C	-10–50						
Ambient humidity %	95 or less						
Power consumption W	AC	7			15		
	DC 24 V	17			24		
Operation frequency	2 times/min or less				1 time/min or less		
Allowable voltage fluctuation	Rated voltage ±10%						

Model-specific specifications

O
 H
 E
 W
 MXB1D — □ —

Model designation	Item	Connection port size	Orifice diameter (mm)	Cv value	Mass (kg)
MXB1D-10		Rc3/8	10	10	1.2 (1.2)
MXB1D-15		Rc1/2	10	6	1.3 (1.3)
MXB1D-20		Rc3/4	15	16	1.4 (1.4)
MXB1D-25		Rc1	20	29	1.6 (1.6)
MXB1D-32		Rc1 1/4	25	50	2.5 (2.7)
MXB1D-40		Rc1 1/2	32	98	3.0 (3.1)
MXB1D-50		Rc2	40	125	3.8 (3.9)

() indicates when the ball valve body material is stainless steel.

O
 H
 MXB1DF — □ —

Model designation	Item	Connection port size	Orifice diameter (mm)	Cv value	Mass (kg)
MXB1DF-15		Rc1/2	15	23	1.4
MXB1DF-20		Rc3/4	20	51	1.6
MXB1DF-25		Rc1	25	66	2.6
MXB1DF-32		Rc1 1/4	32	114	3.0
MXB1DF-40		Rc1 1/2	40	176	3.8